

The Hampden County Radio Association, Inc.

October 3rd Meeting Broadband Dipoles

Our October meeting will be presented by Frank Witt, AI1H, who will clear up many misconceptions and false claims about broadband dipoles. Check your October issue of QST for Frank's article, and come see him in person on Friday October 3rd!

ZERO BEAT

Through the past few months *ZERO BEAT* has undergone a number of major changes. *ZERO BEAT* is composed and produced on an Apple Mac Plus. Some articles are transferred over phone lines, while others are entered from printed material. All articles are then set in the correct font and type size using MacWrite. Aldus Page Maker is utilized to do the actual page layout along with any final modifications that may be necessary. The final copy of the newsletter is printed on an Apple LaserWriter Plus, which has a 300 dot per inch resolution. From there the fine people at Quick as a Wink take over, using an offset process to actually print the copy of *ZERO BEAT* you receive.

KA1KPH is your current *ZERO BEAT* editor. Your articles or suggestions for topics you would like to see are always welcome! Please address all newsletter material to the club address, which is: P O Box 482, West Springfield, MA 01090-0482. Members can receive *FREE* adds for items for sale, etc. Send your copy to the club address.

After *ZERO BEAT* is received from the printer the mailing labels are affixed by Ron, WB1ETS, and his wife Lil, KA1MPS. Ron and Lil maintain the club membership database on their home computer system. *ZERO BEAT* is then mailed third class directly from the main postoffice in Springfield, MA 01101. The non-profit bulk rate permit allows us to mail *ZERO BEAT* for about one third the cost of first class mail. We have noticed that the third class mailings of *ZERO BEAT* have resulted in a two to three day delivery time to most local addresses.

HCRA *ZERO BEAT* October 1986

Please let us know if you receive your copy of *ZERO BEAT* more than six days after its mailing date, and your zip code starts with 010 or 011. If you have any other problems, for example you just didn't get your copy, please contact Ron, WB1ETS, who will be glad check out the situation. You should expect to have your copy of *ZERO BEAT* no later than the Monday mail delivery of the week of the meeting (first Friday of each month).

ARRL Director & Vice Director Nominations

Three nominations were received for Vice Director. Fred Hopengarten, K1VR, was declared ineligible due to his occupation. Clevis Laverty, W1RWG, and Robert Weinstock, KN1K, will appear on a ballot that ARRL members will receive shortly. Please make sure you vote! Tom Frenaye, K1KI, was unopposed in his position of Director. Keep up the good work, Tom!

November Volunteer Examination

On November 1, 1986, the Hampden County Radio Association will sponsor a volunteer examination which will be held at the Hampden Wilbraham Regional High School (Minnechaug). Walk-ins are welcome.

All grades of license examinations will be offered, from Novice to Extra. The session starts promptly at 9:00 AM, but it is suggested that you arrive at least a half hour early to check in, and have your forms validated.

Bring a completed FCC form 610, a check for \$4.25 made out to the ARRL-VEC, a photocopy of your amateur license, and one additional form of identification.

FCC 610 forms can be obtained from the ARRL, the FCC, or at the Hampden County meetings. They will also be available at the exam session, but come early so that you can fill out the form before the session starts.

The next Hampden County sponsored exam session will be held on December 13, 1986 at Minnechaug, to coincide with the completion of the amateur radio classes held in Agawam.

Call Signs

As of August 1, 1986 the following callsigns had been issued by the FCC for the first call area: Amateur Extra NG1N, Advanced KB1ZQ, Tech/General N1EHO, and Novice KA1OUF.

Local Ham Awarded Scholarship

Congrats to Carol Dunlap, KA1NCX, of Southwick, who recently received the Young Ladies' Radio League Scholarship for 1986. These scholarships are administered by the Foundation for Amateur Radio, which represents 50 clubs in MD, DC and northern VA.

Callbooks

The HCRA is again offering Radio Amateur Callbooks. As you may have noticed on the 1986-1987 membership application, either edition is available for only \$17.00 with your dues payment. We will offer callbooks to anyone on an as available basis at \$18.00 each. Please note that shipping is *NOT* included! We expect receipt of the callbooks on or about the first of December. You will not find a lower price anywhere! Please contact Ron, WB1ETS, at (413) 739-5228 for more information, or to place an order.

FOR SALE

FOR SALE or ???... Colins crystal pak... Drake TR-4 transceiver with AC power supply... Hallicrafters HT-37 transmitter... Heath HW-12A transceiver with AC power supply... National HRO-5 receiver with coils and power supply... Heath HO-10 monitor scope... Drake TVI filter... HP audio oscillator... Navy LM-15 frequency meter... Old tube testers... For all these items please call Mike W1DGJ at (413) 583-6678

Please support the HCRA

6m and Up

Fred, N1DPM, is interested in starting a monthly column in *ZERO BEAT* on activities, equipment, or just anything related to VHF, UHF and EME. This month we have an interesting article on modifying the Cushcraft 214-B Jr. Boomer. Fred is planning additional articles on a number of topics but is looking for your support in bringing you a monthly 6m and Up column.

Some ideas on what Fred needs to continue the column are: did you work an interesting grid or state, activity on 902 mhz and above, equipment modifications, new equipment reviews, home brew projects, etc. You *don't* have to write the article, just pass the word to Fred who will put something together. Remember, this is your column - anything will be appreciated!

You can contact Fred through the club mailing address.

Kenwood is Moving

Kenwood Corporation will open its new US headquarters in early 1987. The new Carson California facility has over 200,000 square feet of offices and warehouse space. Kenwood also has plans for another facility in Mt. Olive New Jersey. Watch your favorite magazine for more information!

USAF Network

Dave Montgomery, KA5SKU, reports that the Ground Wave Emergency Network (GWEN) project is proceeding with the construction of a new 300 foot tower in Fayetteville, Arkansas. This installation is one in a network currently under construction by the US Air Force. The purpose of GWEN is to "provide the US strategic forces with the ability to maintain critical long-range command and control communications ability, despite atmospheric disturbances" which would occur after a nuclear war, according to a spokesman at Little Rock AFB.

It is interesting to note that Hanscom AFB in Bedford Massachusetts was one of nine sites that were equipped with the prototype installations in 1983. The forecast is for an additional 57 stations to be on by year's end, with eventually as many as 260 stations in the network.

Support the League!

HCRA *ZERO BEAT* October 1986

License Classes

HCRA sponsored license classes for *ALL* classes of licenses, from Novice through Extra, are being held each Wednesday evening from 7:00 PM to 9:30 PM at the Agawam High School. These classes started on 17-Sep-86, and will run through 10-Dec-86, followed by an ARRL/VEC exam in Wilbraham on 13-Dec-86. There will be no class on 26-Nov-86, the day before Thanksgiving. There is *NO* fee for the classes other than the ARRL license manuals, which are available at the classes.

Although the classes have been underway for a week or two now, you are still encouraged to come by and check them out. We maintain an informal environment, with our goal to help you attain the desired license class. Our motto is: *we will not let you fail*. If you need further information, please call Bob, KA1KPH, at (413) 786-9958.

Remember that the ARRL proposal is now before the FCC, and will modify the Novice license to possibly provide voice and other privileges. We expect some ruling in December. So, if you know *anyone* who may have an interest in obtaining a ticket, please put them in touch with us. Our Novice program will get them the ticket *BEFORE* the FCC makes any changes, included an expected increase in the question pool to 30 questions!

The HCRA Board of Directors unanimously voted to donate \$100.00 to the Mt. Tom ARA to assist in rebuilding the two repeaters on Soapstone that were recently damaged by a lightning storm. The board feels that these machines not only provide a valued service to local hams but also to the communities in our area. We hope that through the generosity of local hams Mt. Tom will be able to restore these two machines to their original state.

Flea Markets

Natchaug ARS: Sunday 21-Sep-86 from 0900 to 1500 at the Elk's home, 198 Pleasant Street (off Route 32), Willimantic, CT. Talkins on 146.52 or 147.30/90. For more info contact Ed Sadeski, KA1HR, at (203) 456-7029 after 1600.

October 4, 1986 is the fall Deerfield NH flea market. See you there!

Mailing

Most of you should have recently received a special mailing by the HCRA. Our goal was to introduce the HCRA to a large number of hams who may be interested in our services. As most of you (hopefully active) hams know, there have been numerous changes in the Amateur Radio service in the past few years. As we see it, these are just the beginnings, with many more changes to come. The ARRL Novice enhancement proposal is just one, for example.

In our role as a Special Service Club, we feel we must keep our offerings in tune with the current needs of the ham community. We will continue to try to bring you fresh new meeting topics. We will work with you to prepare for the FCC exams, and of course, offer ARRL/VEC exams that meet your needs. The production of *ZERO BEAT* will continue to be a high priority, as we work on improvements in both its production and content. The HCRA board is always interested in your input in the club's direction. Please feel free to contact any board member, or stop by a board meeting!

In the mailing we attempted to promote some of our offerings, and those of the ARRL. We feel that the future of ham radio is really in the hands of the League. We included an ARRL membership application in the mailing with the hope that those hams who are not League members may consider joining, and those who are would possibly pass it on to a friend.

We also included The World at Your Fingertips which promotes amateur radio. We hope that Fingertips can be passed on to individuals who may be interested in obtaining a license. You may also want to give them the ARRL application, too! We welcome your referral to our license classes, and will work with anyone to get through the Novice course, and attain what ever grade of license they desire. Your referral *WILL* make a difference!

If you have any comments about the mailing we'd like to hear from you!

Thanks

This issue of *ZERO BEAT* was brought to you by: The ARRL Letter, AMSAT, K1BXE, KA5SKU, KA1KPH, N1DPM

6m and Up

The HCRA club station WINY was again fired up for the ARRL VHF QSO party. Many thanks to Art, W1KK, for hosting the effort and helping out with activities. Also thanks to the multi-op effort by: KA1ZE, AC1T, KA1KPH, NC1B, NC1I, N1DPM, WA1UQC, and W1KK. Here are the preliminary results as tabulated by Fred, N1DPM:

Band	OSO's	Grids
6m	155	32
2m	364	42
125cm	73	22
70cm	91	27
23cm	27	10

Total score claimed is: 123,424

Although band conditions were poor here, we have heard that openings were seen down at WS4F. In addition, the fine weekend weather didn't help activity; it seemed like most people were outside enjoying the weather and not operating in the contest. Local FM was almost non-existent! With all this it is still felt that we will place in the top ten nationally! Watch QST for the results, most likely in January.

Dues

Your HCRA dues are due by November 1st! Applications were mailed with last month's *ZERO BEAT*, or can be obtained at any HCRA meeting. Your continued support is appreciated. Don't delay; do it today!

Ham Tales

The HCRA has received a request from Lenore Jensen, W6NAZ, for tales about ham radio. She writes: "I am compiling a book HAM TALES which is a collection of experiences in Amateur Radio, of interest to a general reader. I can use rescues, coincidences and amusing experiences with or because of ham radio." She also notes that the proceeds from this book will go to the ARRL Foundation.

Please write her directly. Lenore Jensen
W6NAZ, 14867 Round Valley Drive,
Sherman Oaks, CA 91403

HCRA Repeaters

KA1JJM/R 147.105 mhz
KA1KPH/R 449.175 mhz
WINY-1 145.010 packet
W1HGJ/R 426.250 ATV

AMSAT OSCAR-10 and JAS-1/FO-12

AO-10 has relapsed and is again in serious condition. The computer has resisted repairs attempted recently. The Mode B transponder has been on continuously jeopardizing the batteries. Since the telemetry is absent, the battery condition is unknown. AMSAT says until further notice Mode B may be used for QRP only between MA 60 and 140. QRP means 100w ERP or less. Watch for updates to this advisory.

On a better note, the JARL has accepted an offer to rename their JAS-1 satellite. Henceforth it will be known as Fuji OSCAR 12, or simply FO-12, in honor of the 25 year legacy of OSCARS. FO-12 was launched on 12-Aug-86. Mode JA uplink is 145.900 through 146.000, with the corresponding downlink 435.900 through 435.800 (inverting). The sum of the uplink and downlink frequencies equals 581.800 mhz exclusive of Doppler shift. The beacon frequency has been measured at 435.797 mhz.

FCC Pulls the Switch on Tandy PC's

The FCC has forced Tandy (Radio Shack) to stop marketing its 1000 SX and EX model PC's. Tandy was also fined an undisclosed amount by the FCC for selling uncertified products. The FCC has ordered Tandy Corp. to discontinue the display and demonstration of the machines, as well as terminate accepting orders for units, until Tandy makes the necessary modifications to pass the FCC certification.

FCC certification is required for most electronic equipment, including PC's and Amateur Radio rigs. The certification ensures that a device can be operated without causing harmful interference to other equipment and people.

FCC Inquiry on ATIS Systems

Remember Captain Midnight? Are you wondering what the government and industry has on mind to ensure it won't happen again? FCC General Docket 86-337 has proposed establishing an automatic transmitter identification system (ATIS) signal on *ALL* satellite video uplinks, and

has asked for comments for ATIS for *ALL* services and *ALL* radio transmitters.

ATIS is a unique, unchangeable identifying number assigned to each transmitter at the time of manufacture, plus some correlation of the number to a database identifying the licensee. This signature is automatically added to the unit's transmission, and provides a positive identification of each radiated signal. An ATIS system could take the place of all existing voice identification requirements!

The Commission asks the following questions in its inquiry: In what services would ATIS be beneficial? Should it be imposed on *ALL* services? The Commission suggests that all new amateur transmitters contain an ATIS ID system as of 01-Jan-93. Comments are due by October 20, 1986. The ARRL will file comments opposing ATIS as inappropriate in our service.

HCRA now offers ARRL WAS & VUCC Awards!

As part of the ARRL's Special Service Club program, the HCRA is now handling a number of ARRL awards. Doc Webb, W1HOD, is our ARRL awards coordinator, and will be glad to work directly with you. If you are interested in either the ARRL Worked All States or VHF UHF Century Club awards please contact him directly. His mailing address is: W1HOD, Doc Webb, 4 Bullard Ave, Holyoke, MA 01040.

Future Meetings

Annual HCRA Fall Auction

The HCRA Annual Auction will be on Friday November 7th at the Granger School in Feeding Hills center. The doors will open at 6:00 PM, and the auction starts promptly at 7:00 PM. If you are looking for some equipment, or just want to unload that boat anchor, this is the place to do it!

December Meeting

Stop by the December 5th meeting for the first annual HCRA Gab Fest, complete with finger food and show and tell. Many local hams will be on hand with what's new (and not so new) in ham radio. Come by and meet other hams, and check out what equipment may be on your XMAS list..... and find out what finger food really is!

2.2λ 12 Element NBS/N1DPM Yagi

Frequency = 144.5 mhz

Spacing $0.2\lambda = 16 \frac{3}{8}$ inches

Element	Stock Length	Percent of Error	Corrected Length	Remove each end
Reflector	40 $\frac{3}{16}$	-1.5%	40 $\frac{3}{16}$	0
Driven	38	-0.5%	38	0
Director #1	37 $\frac{7}{16}$	-1.5%	37 $\frac{7}{16}$	0
Director #2	36 $\frac{9}{16}$	-1.5%	36 $\frac{9}{16}$	0
Director #3	36 $\frac{1}{16}$	-1.5%	36 $\frac{1}{16}$	0
Director #4	35 $\frac{9}{16}$	-1.0%	35 $\frac{3}{8}$	- $\frac{3}{32}$
Director #5	35	-1.0%	34 $\frac{3}{4}$	- $\frac{1}{8}$
Director #6	35	-1.0%	34 $\frac{3}{4}$	- $\frac{1}{8}$
Director #7	35	-1.0%	34 $\frac{3}{4}$	- $\frac{1}{8}$
Director #8	35	-1.0%	34 $\frac{3}{4}$	- $\frac{1}{8}$
Director #9	35 $\frac{9}{16}$	-1.0%	35 $\frac{3}{8}$	- $\frac{3}{32}$
Director #10	36 $\frac{1}{16}$	-1.5%	36 $\frac{1}{16}$	0

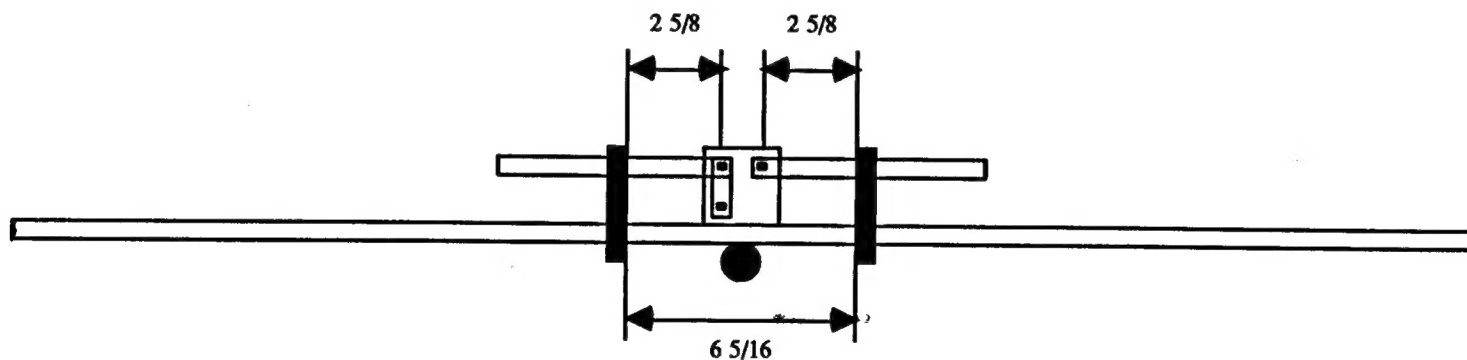
Figure 1

K1IJU Receives 1986 Pyncheon Award

Norm Peacor, K1IJU, has been selected by the Advertising Club of Western Massachusetts to receive the 1986 Pyncheon Award, given in recognition of "devoted citizenship and distinguished civic services." The Pyncheon Award, established in 1915, is presented annually to one or more citizens of Greater Springfield.

Norm is executive vice president and chief actuary for Massachusetts Mutual Life Insurance Co., and former president of the Hampden County Radio Association, Inc. Norm is also chairman of the board of trustees at Western New England College and a member and past president of the board of directors of United Way of Pioneer Valley Inc.

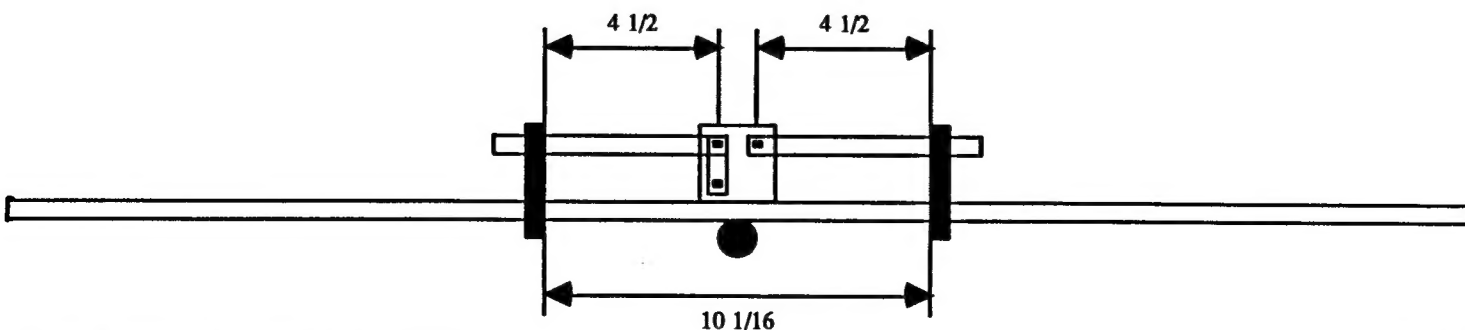
He is also a former member of the board of directors and past president of the Springfield Orchestra Association Inc., a member of the board of trustees of Baystate Medical Center Inc. and Baystate Health Systems Inc., a trustee of Wing Memorial Hospital, a corporator of Springfield Institution for Savings, and a past treasurer of the United States Chess Federation.



Stock Jr. Boomer

Figure 2

NBS/N1DPM 12 Element 2.2λ



In Search of the Perfect Antenna (without gimmicks)

by Fred Stefanik N1DPM

After reworking my tower last summer, I became a bit puzzled. I increased my tower from 45 to 70 feet of Rohn 25G. My 2 meter antennas were a pair of Cushcraft 32-19 boomers, one at 46 feet, and the other at 58 feet, with the 12 foot spacing as recommended by Cushcraft. My phasing lines and power divider were not the best, including 20 year old RG11AU. In the effort to streamline the installation on the new tower I purchased one of the new superyagis: a KLM 2M-16 LBX, which is 16 elements on a 28 foot boom! Figuring the 2.7 dB stacking gain and approximately 1 dB for phasing loss I felt the two 32-19's should compare to one 2m-16 LBX. With the LBX mounted five feet above the top of the tower I also felt that the added 30 feet above ground should make an impact on antenna performance. Needless to say I was more than disappointed. After being on 2m with a high performance station since 1979, including a tower preamp and a kilowatt, I found I could no longer work Virginia regularly. This did not make any sense! My good friend Stan, KA1ZE, noticed the same type of results with his LBX at 135 feet on top of a 1,000 foot hill in Tolland, CT. After some discussion with Stan we felt it was time for a change. About four years ago Stan had eight Cushcraft 214-B Jr. Boomers up on the side of his 120 foot Rohn 45G tower. He took them down and went back to HF contesting a couple of years ago. We again decided to put them to use with four for him and four for me. Checking to see how the 214-B was designed it turned out to be basically a 2.2λ NBS antenna with a *gimmick*, the trigonal reflector.

All we were after was high-performance yagis without any gimmicks. We proceeded to clean the eight antennas up and remove the tri-reflectors. The first problem we encountered was that all the SO-239 connector center pins were corroded beyond belief! John, AC1T, noticed the same problem with his 214-B. He contacted Dave Olean, K1WHS, at Cushcraft. Dave recommended that the back side of the connectors should be sprayed with a clear polyurethane or clear krylon. This will seal the connectors. New center pins are available from Cushcraft at a nominal cost.

The next step is to remove the tri-reflector. The proper reflector spacing is 0.2λ or 16 3/8 in, the same as all the directors. It was easy to drill these accurately with a machine shop at our disposal. John did his with a hand drill with quite good results. Even if your holes are slightly off you can still bend the reflector element to align it properly.

Next came checking the element lengths to be sure they met NBS specifications. Low and behold I found that they were all short for an antenna that is to be used between 144.0 mhz and 144.3 mhz. As shown in figure 1, some are 1.0% short, some 1.5%, and the driven element is 0.5% short. A little bit of logic tells you that if you were to manufacture two 2m yagis one would be for SSB/CW and the other for FM. Remember that the 2m FM activity occurs between 144 and 148 mhz. Knowing this you might center the SSB/CW antenna at 145 mhz and the FM yagi at 147 mhz. Eureka! A few simple calculations and you will see the 214-B is cut for about 145.25 mhz or so. There is still the percentage problem. Why was the whole yagi not scaled up by the same amount?

Due to the lack of ability to create aluminum rod, I decided to use the hacksaw and file method. Shortening D4 through D9 by the amount shown in figure 1 will adjust the antenna so that all elements are cut for the same frequency. Referring to a article in HAM RADIO by Joe Riesert, W1JR, no boom correction is required with the Cushcraft style mounting.

Now on to the driven element. In every article I have ever seen on yagis, all of them say that the driven element length is not critical *except* for matching. The stock element length is acceptable on the 214-B. Digging deeper into the match system you will find it is a T match without capacitors. The most important thing in this match is the 180 degree $1/2\lambda$ coax balun must be the correct length. It does not make any difference if this phase line is 50Ω (RG213) or 75Ω (RG11). The 75Ω will give a little broader bandwidth because it is closer to the ideal 125Ω mean impedance. The Cushcraft balun as it comes is one inch too short! The proper length should be calculated by: $1/2\lambda = 492/144.2 \text{ mhz} = 3.4119 \text{ feet or } 40.943 \text{ inches}$. Adjusting for the 0.66 velocity factor yields 27.02

inches. The desired operating frequency is 144.2 mhz. On Cushcraft antennas you should allow two inches for the female connectors on the antenna. The correct resultant length is 25 inches tip to tip. The stock Cushcraft length is 24 inches. This length is important because if it is too long or short it will skew the pattern. Odd lobes will pop-up and the antenna gain will decrease as the parasitic elements are no longer centered. Always use a high quality coax of known characteristics, such as RG213. The correct length for a 214-FB FM Jr. Boomer would be 24.5 inches.

Now for the antenna tune-up. Trial and error determined that the T match setting for 2m SSB/CW operation should be 10 1/16 inches from inside to inside as shown in figure 2. Cushcraft's old dimension was 6 5/16. The simple way to measure this is to go 4 1/2 inches from the center of the connector center pin to the inside of the T bars. Keep this balanced! As not having done a 214-FB you will have to do some experimentation yourself if you have a FM Jr. Boomer.

The one last thing to consider would be a boom support, not to remove any boom sag, but to strengthen the antenna for ice loading. Frank, NC1I (ex WA1RWU), lost twelve 214-B's in ice storms when he was contesting from Washington, MA.

The 2.2λ NBS/Cushcraft/N1DPM 2m 12 element yagi has a really clean pattern with one clean main lobe and a couple of small rear lobes. The front to back ratio is on the order of 20 dB to 25 dB, and the gain is unchanged from the 214-B's claimed (inflated) figure of 15.2 dBd. The real gain, as specified in the NBS notes, is 12.2 dBd. I believe the NBS notes more than the manufacturer's.....

If you are so inclined to put up multiples of these, they should be stacked at: 9'7" vertically (h-plane) and 11'2" horizontally (e-plane). These stacking distances are courtesy of Steve Powlishen, K1FO, and were computer generated for best pattern versus array temperature. Good luck with your new *gimmick free* VHF yagis. By the way, as for the title, if there was such a thing as the perfect antenna, everyone would have one! So use what works best for you!

Figures appear on page 4

Need more information?

The following hams are ready to answer your questions on:

- HCRA & ARRL membership
- Upcoming HCRA meetings
- HCRA fall license classes
- ARRL/VEC exams

Please call...

Yorke Phillips K1BXE 566-3010
 Steve Nelson WA1EYF 596-8216
 Ray Burk WB1GLX 730-2774 days
 Ray Burk WB1GLX 596-6403 eves
 Bob McCormick KA1KPH 786-9958
 Ned Carpenter NB1R 596-4625

Or write directly to the club!

ARRL/VEC Sessions

November 1st

December 13th

Minnechaug Regional High School
 Main Street, Wilbraham MA

Walkins Always Welcome!

We also handle one-on-one exams for those who have special needs or are unable to attend a scheduled session.

Please contact Yorke Phillips, K1BXE, for more information on the ARRL/VEC program.

Next Meeting
October 3, 1986

FALL LICENSE CLASSES

FCC license classes for Novice, Tech/General, Advanced, and Extra will begin on September 17th and run every Wednesday through December 10th. There will be no class on November 26th. Classes are at the Agawam High School, Route 57, Agawam MA. Classes start promptly at 7:00 PM and run no later than 9:30 PM. ARRL license manuals will be on sale at the classes: Novice \$7.00, all others \$5.00, FCC manual \$4.00. There is *NO* charge for the classes. Although classes have already started please feel free to stop by - and upgrade!!!

HCRA Meetings

First Friday of each month at
 Feeding Hills Congregational Church
 Center of Feeding Hills
 Intersection of routes 57 & 187
 Doors open at 7:30 PM
 Meeting starts promptly at 8:00 PM
All hams are welcome to attend!

Annual HCRA Fall Auction

Friday November 7th at the Granger School in Feeding Hills center. Doors open at 6:00 PM, auction starts at 7:00 PM. Call Ron at 413-739-5228 for more information.

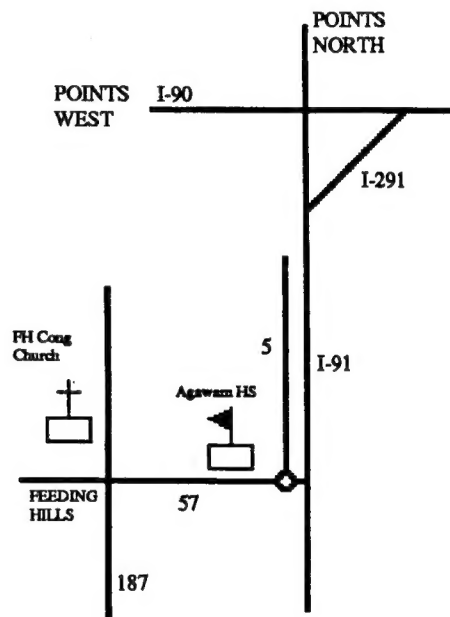
HCRA December Meeting

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October 3rd Meeting

Broadband Dipoles

Presented by Frank Witt, AI1H. Check your October issue of QST for Frank's article, and come see him in person on Friday October 3rd!



Hampden County Radio Association, Inc.

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West Springfield MA 01090-0482

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